

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a P-type semiconductor substrate;

5 a first N-well formed on a surface of the P-type semiconductor substrate

a P-channel transistor formed in the first N-well;

a first P-well formed in the first N-well;

a N-channel transistor formed in the first P-well; and

a second N-well formed apart from the first N-well on the P-type semiconductor substrate,

10 the second N-well and the first N-well having substantially a same impurity concentration profile; and

a vertical NPN bipolar transistor formed in the second N-well and using the second N-well as a collector of the vertical NPN bipolar transistor.

15 2. The semiconductor device of claim 1, further comprising a second P-well formed in the second N-well that has substantially a same impurity concentration profile as the first P-well, wherein the second P-well is configured to be a base of the vertical NPN bipolar transistor.

20 3. The semiconductor device of claim 1, further comprising a third N-well formed on the surface of the P-type semiconductor substrate that has substantially a same impurity concentration profile as the first and second N-wells, a third P-well formed in the third N-well that has substantially a same impurity concentration profile as the first P-well, and lateral NPN bipolar transistor formed on the third P-well and using the third P-well as a base of the lateral NPN bipolar transistor.

25 4. The semiconductor device of claim 1, further comprising a fourth N-well formed in the first N-well that is shallower than the first N-well, the P-channel transistor being formed in the fourth N-well, a fifth N-well formed on the P-type semiconductor substrate that has substantially a same impurity diffusion depth as the fourth N-well, and a lateral PNP bipolar transistor formed on the fifth N-well and using the fifth N-well as a base of the lateral PNP bipolar transistor.

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5. The semiconductor device of claim 1, further comprising a fourth N-well formed in the first N-well that is shallower than the first N-well, the P-channel transistor being formed in the fourth N-well, a sixth N-well formed on the P-type semiconductor substrate that has substantially a same impurity diffusion depth as the fourth N-well, and a vertical PNP bipolar transistor formed on the sixth N-well and using the sixth N-well as a base of the vertical PNP bipolar transistor.